

Mini Review

Ceftriaxone in pediatrics: Indication, adverse drug reaction, contraindication and drug interaction

Gudisa Bereda*

Department of Pharmacy, Negelle Health Science College, Guji, Ethiopia

Abstract

Ceftriaxone is having many uses and useful “third-generation” cephalosporin that necessitates being given every day. Ceftriaxone acts as binds to one or many of the penicillin-binding proteins which inhibit the final transpeptidoglycan step of peptidoglycan synthesis in the bacterial cell wall, thus inhibiting biosynthesis and arresting cell wall assembly resulting in bacterial cell death.

Ceftriaxone-associated biliary adverse events in children less than eighteen years cause biliary pseudolithiasis and scarcely nephrolithiasis often happen in children less than eighteen years after receiving overdoses of ceftriaxone. Ceftriaxone perhaps binds with calcium and figure insoluble chelation leading to biliary pseudolithiasis. Cholelithiasis, increased biliary thickness, and pseudolithiasis rarely happen in a period of being a child, but there are two modes of distribution described by two peaks, the first being at an early stage of development and the second is a period of life when a child develops into an adult. Hyperbilirubinemia is significantly contraindicated for neonates administrated ceftriaxone, particularly premature neonates, because of the displacement of bilirubin from albumin-binding sites and increase in blood concentrations of free bilirubin. A child than one month old and a child less than twelve-month old in special are at great risk of poor results because of bilirubin encephalopathy. Coincident administrations of ceftriaxone with aminoglycosides such as gentamycin and loop diuretics (furosemide) perhaps increase the risk of nephrotoxicity (rapid degeneration in the kidney function to the toxic outcome of double or triple medications). Coincident administrations of ceftriaxone with anticoagulant medications such as warfarin are associated with bleeding due to increased prothrombin times, which is reversible with vitamin K.

Introduction

Ceftriaxone is a parenteral cephalosporin with broad antimicrobial activity. Ceftriaxone is an antibiotic that is commonly used to treat infectious diseases caused by bacteria. Ceftriaxone is having many uses and useful “third-generation” cephalosporin that requires to be given every day. It commonly acts on significant gram-positive and most gram-negative bacteria [1]. Ceftriaxone is an injectable cephalosporin with a wide anti-infective spectrum and has a prolonged elimination half-life of eight hours [2]. Ceftriaxone is a bactericidal agent that acts by inhibiting bacterial cell wall secretion. Ceftriaxone has activity in the presence of certain beta-lactamases, both penicillinase, and cephalosporins, of Gram-negative and Gram-positive bacteria. Ceftriaxone acts as binds to one or many of the penicillin-binding proteins which inhibit the final transpeptidoglycan step of peptidoglycan synthesis in the bacterial cell wall, thus inhibiting biosynthesis and preventing cell wall assembly sequencing in bacterial cell death [1].

Indications

Ceftriaxone is used for the management of neonatal sepsis and meningitis caused by susceptible gram (-ve) microorganisms (e.g. *E. coli*, *P. aeruginosa*, *Klebsiella*, *H. influenzae*) and for the management of gonococcal infections. Ceftriaxone distributes broadly in CSF, bile, bronchial secretions, lung tissue, ascitic fluid, and the middle ear. Ceftriaxone is eliminated unchanged by dual biliary (40%) and renal mechanisms. Serum half-life in infants born before the normal time is five to sixteen hrs. Only infants who have hepatic and renal impairment concurrently seek dose adjustment significantly [3].

Adverse drug reaction

The most common adverse drug reaction associated with administrating ceftriaxone involves allergic reactions (rash, eosinophilia, fever, anaphylactoid shock, etc), gastrointestinal disturbances, and temporary escalate in transaminases,

More Information

*Address for Correspondence: Gudisa Bereda, Department of Pharmacy, Negelle Health Science College, Guji, Ethiopia, Email: gudisabareda95@gmail.com

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ORCID: orcid.org/0000-0002-5982-9601

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Keywords: Adverse drug reaction; Ceftriaxone; Contraindication; Drug interaction; Pediatrics; Indication

Abbreviations: Ca₂: Calcium; CaCl₂: Calcium Chloride; CSF: Cerebrospinal Fluid; GI: Gastrointestinal; IV: Intravenous





nephrotoxicity, pseudomembranous colitis, blood dyscrasias, hematological anomalies (granulocytopenia, thrombocytopenia, hemolytic anemia) and gallbladder deliverance inadequacy [4-6]. Certain side effects of ceftriaxone are illustrated beneath; Ceftriaxone-associated biliary adverse events in pediatrics are cause biliary pseudolithiasis and scarcely nephrolithiasis often happens in children less than eighteen years who receive overdoses of ceftriaxone [7]. Ceftriaxone-associated renal adverse events in pediatrics result in urolithiasis in children less than eighteen years, which could also cause acute kidney injury [8]. Ceftriaxone perhaps binds with calcium and figures insoluble chelation influencing biliary pseudolithiasis [9]. Cholelithiasis, escalated biliary thickness, and pseudolithiasis rarely happen in a period of being a child, but there are two modes of distribution described by double peaks, the 1st being at an early stage of development and the 2nd in a period of life when a child develops into an adult [10,11]. Ceftriaxone-associated hemolysis in pediatrics due to the availability of a substance produced by the body to fight disease against ceftriaxone, and the judgment displaced immune complex type lysis of red blood cells with the liberation of hemoglobin [12]. Ceftriaxone displaces bilirubin from albumin attaching sites; ceftriaxone generated escalation of free bilirubin and erythrocyte-bound bilirubin and de-escalates unconjugated bilirubin. Ceftriaxone reveals a substantial replacing consequence at accumulations gathered among therapeutically used and should be used with precaution in more-risk jaundiced a very young child [13]. Determination of free bilirubin, erythrocyte-bound bilirubin, and unconjugated bilirubin was used to test the outcomes of ceftriaxone on the binding of bilirubin to albumin [14].

Contraindication

Hyperbilirubinemia is significantly contraindicated for neonates administrated ceftriaxone, particularly premature neonates, because of the displacement of bilirubin from albumin-binding sites and increase in blood concentrations of free bilirubin. A child than one month old and a child less than twelve months old in special are at great risk of poor results because of bilirubin encephalopathy [15-17]. Ceftriaxone for parenteral is not given for patients with a history of having cephalosporin category of antibiotics allergies [18]. Coadministration of ceftriaxone and calcium-containing solutions or products in a child less than a month old is contraindicated: ceftriaxone reacts to calcium-containing solution and it can chelate in lungs and kidneys of a child less than twenty-eight days years and this could be life-threatening. Consequently, ceftriaxone is also contraindicated in a child less than twenty-eight days years if they are anticipated to take any calcium-containing products. Coincident usage of IV ceftriaxone and calcium-containing solutions in neonates and young infants has been associated with calcium chelation. Ceftriaxone is discordant with theophylline, azithromycin, CaCl₂, Ca gluconate, caspofungin, fluconazole, and vancomycin [19].

Drug interactions

Disulfiram-like reaction enclosing ceftriaxone in a child less than eighteen years patient: disulfiram-like reactions between ceftriaxone and ethanol have been well defined in the literature. The reaction's mechanism involves disulfiram or the falling medication preventing aldehyde dehydrogenase, the enzyme responsible for converting acetaldehyde product of metabolism of ethanol to acetate. The sequencing increases in harmful blood acetaldehyde leads to clinical outcomes that categorize in severity and that are common to the amount of being exposed to alcohol and falling medicine. Rare reactions are clearly shown as vasodilation sequencing in flushing and headache, while moderate to severe reactions can develop from nausea and vomiting to hypotension, dysrhythmia, and death [20-22]. Disulfiram-like reactions among ceftriaxone and ethanol are extremely infrequent. Coincident administrations of ceftriaxone with aminoglycosides such as gentamycin and loop diuretics (furosemide) perhaps increase the risk of nephrotoxicity (rapid degeneration in the kidney function due to the toxic outcome of double or triple medications). Coincident administrations of ceftriaxone with anticoagulant medications such as warfarin are associated with bleeding due to increased prothrombin times, which is reversible with vitamin K [23,24].

Conclusion

Ceftriaxone is having many uses and useful "third-generation" cephalosporin that requires to be given every day. Ceftriaxone acts as binds to one or many of the penicillin-binding proteins which inhibit the final transpeptidoglycan step of peptidoglycan synthesis in the bacterial cell wall, thus inhibiting biosynthesis and arresting cell wall assembly sequencing in bacterial cell death.

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Data sources

Sources searched include Google Scholar, Research Gate,



PubMed, NCBI, NDSS, PMID, PMCID, and Cochrane database. Search terms involved: indication, adverse drug reaction, contraindication, and drug interaction of ceftriaxone in pediatrics.

Availability of data and materials: The datasets generated amid the recent survey are available with the correspondent author.

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